CLAIMS

1. A method for determining a data rate using sub-band capacity in a communication network having a first modem in communication with a second modem over a communication channel, the method comprising the steps of:

receiving a signal from a first modem;

determining from the signal, information concerning line conditions on a communications channel associated with the first modem;

calculating an estimate of channel capacity using a geometric mean of capacities of a plurality of frequency domain sub-bands; and

determining a data rate based on the estimate of channel capacity.

2. The method of claim 1, further comprises the step of:

determining a signal power for each sub-band.

3. The method of claim 1, further comprises the step of:

determining a noise power for each sub-band.

4. The method of claim 1, wherein each sub-band is determined with a discrete Fourier transform.

5. The method of claim 1, wherein each sub-band is sufficiently small such that noise within the sub-band is approximately additive white and gaussian noise.

6. The method of claim 1, wherein the steps are performed during a line probe session between pre-activation handshaking sessions between a plurality of modems to evaluate performance of a plurality of data rates across a communication channel.

7. The method of claim 1, wherein the step of calculating further comprises the steps of:

sampling a noise signal;

computing a discrete Fourier transform of the noise signal; and

estimating a noise power spectral density for the noise signal.

8. The method of claim 7, further comprising the steps of:

sampling a transmit signal;

computing a discrete Fourier transform of the transmit signal; and

estimating a signal and noise power spectral density.

9. The method of claim 8, further comprising the steps of:

computing capacity of each frequency sub-band; and

summing the capacity of each frequency sub-band to generate a total capacity.

10. The method of claim 1, wherein at least one of the first modem and the second modem operate according to the G.SHDSL standard for spectral compatibility.

11. The method of claim 1, wherein the step of determining a data rate, further comprises the step of:

comparing the estimate of channel capacity for a plurality of rates of interest.

12. The method of claim 1, wherein the steps are performed at a customer premise equipment.

13. The method of claim 1, wherein the steps are performed at a central office.

14. In a communication network having a first modem in communication with a second modem over a communication channel, a system for conducting symbol rate negotiation and determining a preferred rate, the system comprising:

a receiving module for receiving a signal from a first modem;

a line condition determining module for determining from the signal, information concerning line conditions on a communications channel associated with the first modem;

a calculating module for calculating an estimate of channel capacity using a geometric mean of capacities of a plurality of frequency domain sub-bands;

a data rate determining module for determining a data rate based on the estimate of channel capacity.

15. The system of claim 14, wherein a signal power is determined for each sub-band.

16. The system of claim 14, wherein a noise power is determined for each sub-band.

17. The system of claim 14, wherein each sub-band is determined with a discrete Fourier transform.

18. The system of claim 14, wherein each sub-band is sufficiently small such that noise within the sub-band is approximately additive white and gaussian noise.

19. The system of claim 14, wherein the system operates during a line probe session between pre-activation handshaking sessions between a plurality of modems to evaluate performance of a plurality of data rates across a communication channel.

20. The system of claim 14, further comprising:

a noise sampling module for sampling a noise signal;

a noise transform computing module for computing a discrete Fourier transform of the noise signal; and

a noise estimating module for estimating a noise power spectral density for the noise signal.

21. The system of claim 20, further comprising:

a transmit sampling module for sampling a transmit signal;

a transmit transform computing module for computing a discrete Fourier transform of the transmit signal; and

a transmit estimating module for estimating a signal and noise power spectral density.

22. The system of claim 21, further comprising:

a capacity computing module for computing capacity of each frequency sub-band; and

a capacity summer for summing the capacity of each frequency sub-band to generate a total capacity.

23. The system of claim 14, wherein at least one of the first modem and the second modem operate according to the G.SHDSL standard for spectral compatibility.

24. The system of claim 14, wherein the estimate of channel capacity is compared for a plurality of rates of interest.

25. The system of claim 14, wherein the system is located at a customer premise equipment.

26. The system of claim 14, wherein the system is located at a central office.

27. The method of claim 1, wherein the estimate of channel capacity is calculated by

$$C = B_s\left(\sum_{k=\alpha}^{\beta}\log_2\left(|\hat{W}(k)|^2\,10^{\frac{(\Gamma-G+\gamma+\delta)}{10}}+|\hat{S}(k)|^2\right)-\sum_{k=\alpha}^{\beta}\log_2\left(|\hat{W}(k)|^2\,10^{\frac{(\Gamma-G+\gamma+\delta)}{10}}\right)\right)$$

where $B_s = \frac{B}{(\beta-\alpha+1)}$; $0 < \alpha < \beta <$ N-1; B_s represents a sub-band width in Hz; $\hat{S}(k)$ represents an estimated power spectrum of signal; $\hat{W}(k)$ represents an estimated power spectrum of noise; Γ represents a gap from a theoretical channel capacity for PAM signals in dB; G represents a coding gain of a Trellis decoder in dB; γ represents a required margin in dB; δ represents an implementation loss in dB, α represents an index of a first sub-band and β represents an index of a last sub-band.